ray wave-length, runs after or during raying, aging of catalyst, etc. In further experiments now under way, lower temperature with measurement at 4 points instead of one in the catalyst, constant (and lower) humidity of air independent of the atmosphere, measured volumes of gases passed very slowly over the catalyst so as to insure nearly isothermal conditions, and a smaller amount of catalyst are important improvements which have been introduced.

Summary.—(1) Preliminary experiments indicate that X-rays do not activate the platinum catalyst when the catalyst is rayed in an atmosphere of dry air.

(2) The platinum catalyst is activated when rayed in an atmosphere of moist air. Singular effects are noted with time after raying and following irradiations subsequent to the first.

(3) Moisture has a decided effect upon the percentage conversion of $SO_2 + {}^1/_2O_2 = SO_3$ at low temperatures.

(4) A successful laboratory scale apparatus and a proper method for separation of SO_2 and SO_3 have been developed and a satisfactory method of analysis has been devised.

[1] *Zeit. Elektrochem.*, **28**, 472 (1922); **29**, 470 (1923).

[2] *J. Chem. Soc.*, **65**, 611 (1894); **81**, 272 (1902); cf. Lamb and Vail, *J. Am. Chem. Soc.*, **47**, 123 (1925).

THE JAPANESE WALTZING MOUSE, ITS ORIGIN AND GENETICS[1]

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The Japanese waltzing mouse has long been an object of popular and scientific interest, largely on account of its habit of running in circles, the so-called waltzing. However, because of its susceptibility to disease and sensitiveness to temperature changes it is difficult to breed, with the result that its behavior in inheritance, particularly in relation to other characters, has not been thoroughly investigated.

A more or less complete survey of the linkage relationship of waltzing to other characters has recently been made, with some interesting results. It was found, as had previously been suggested by other investigators, that in all probability, the Japanese mouse, of both the waltzing and the non-waltzing form, is a derivative of *Mus wagneri* and not *M. musculus*, the common house mouse. Wagner's mouse is a native of

Central Asia, quite abundant in the plains and plateau regions, but rare or absent in the mountains and coastal areas. This conclusion as to its ancestry is based on a number of independent observations, each one in itself more or less conclusive.

(1) The earliest records of this race of mice point toward central Asia as the place of its origin, it being known originally as the "Nankin mouse." From this region probably it was distributed to the coastal regions of China and also to Japan. Records show that it was domesticated as a household pet certainly as early as the end of the 18th century, perhaps much earlier. This probably was many years before the house mouse was introduced in those countries.

(2) In all body measurements, such as length of body, tail, hind and fore foot and skull, number of vertebrae and scale rings of the tail, position of posterior nares and incisor alveoli, the Japanese waltzer resembles Wagner's mouse quite closely. In fact, deviations from the present wild form of wagneri are no greater than one would expect in any domesticated variety.

(3) A characteristic pigmentation of the eye is apparently common to both the Japanese and Wagner's mouse, but is not found in the house mouse. In the Japanese mouse the retina of the eye alone possesses pigment, while the choroid is practically devoid of it; a similar condition is found in Wagner's mouse. In the house mouse and its derivatives however, with the exception of one mutational variety, both retina and choroid are pigmented.

(4) The protein specificities, as determined by precipitin tests of both the Japanese and Wagner's mouse, differ from that of the common fancy varieties. This indicates that the Japanese mouse is not a derivative of the ordinary races nor intimately related to them. The identity in specificity of the Japanese with Wagner's mouse has not been adequately tested for lack of fresh material.

(5) Finally, the heterosis or hybrid vigor resulting from the cross of the Japanese mouse with the common fancy varieties is such as would be expected only in an inter-specific cross. Intra-specific crosses do not, as a rule, yield such increase in size, vitality, metabolic and reproductive vigor as is found in the cross between the Japanese waltzer and the varieties of the house mouse.

It is quite certain that the common, so-called fancy races of mice are derivatives, through mutations, of the house mouse, *Mus musculus;* therefore any cross between these and the pure Japanese race would be a species cross. One such cross was made involving five visible and distinct characters of coat and eye colors. A peculiar result followed, in that the characters of the Japanese waltzer tended to remain together in F_2 instead of assorting freely as is usual in intraspecific crosses. This ten-

dency was strong enough to distort the expected Mendelian ratios to the extent of 5.27 times the probable error in the straight F_2 generation, and 6.27 times the probable error in the back cross generation. These numbers are based on a total population of 2435 individuals (1146 F_2 and 1289 back cross) and are therefore quite significant. All body measurements likewise show a definite tendency for the factors of size and structural peculiarities to form specific groups. All the characters of each parental species tend to associate together in inheritance. There is no apparent incompatibility between the chromosomes of the two species, for, so far as known, all combinations are viable, yet the chromosomes of each species tend to segregate as a group and not at random. These "associated systems" of specific characters are completely destroyed in the F_2 generation, where all characters behave as in a common Mendelian system. What the mechanism is which holds them together in the F_1 generation is unknown at present.

[1] Contribution from the Genetics Laboratory of the Bussey Institution, Harvard University.

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*A STATISTICAL APPROACH TO THE EPIDEMIOLOGY OF CHOLERA IN MADRAS PRESIDENCY**

BY A. J. H. RUSSELL

MADRAS PRESIDENCY

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India has long been recognized to be one of the important endemic centers for cholera, and because of its importance as a source of spread of infection to other countries of the world it has been the custom in discussing the epidemiology of cholera to ignore the individual epidemics more or less, and to spend time in tracing the method of spread of the pandemic. For India, however, it is the individual epidemic or local outburst which is of first importance and in an attempt to elucidate some of the problems connected with the disease it seemed worth while to examine the monthly mortality figures for cholera over a period of years. This has been done for the years 1902–21 for the Presidency of Madras, which, with a population of nearly 43 millions of people, may be said to constitute a fairly good random sample of the 350 millions now living in India.

Geographically, the Presidency of Madras may be roughly divided into two zones, the dividing line which follows the course of the Eastern Ghauts

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